Swarm Deterrence in the Strait of Hormuz: Iran's IRGC Navy, Asymmetric Maritime Strategy, and the Future of Littoral Warfare

Douglas C. Youvan

doug@youvan.com

www.youvan.ai

February 26, 2026

In the confined waters of the Persian Gulf and the Strait of Hormuz, naval power is shaped as much by geography and cost asymmetry as by tonnage and technology. Over the past two decades, Iran—principally through the Islamic Revolutionary Guard Corps Navy (IRGC Navy)—has refined a doctrine centered on small, fast attack craft, distributed missile platforms, mines, drones, and coastal batteries. Often described as a "mosquito fleet," this approach is not designed to defeat blue-water fleets ship-for-ship, but to complicate their operations, saturate defensive systems, and raise the economic and political costs of intervention. Recent drills, temporary waterway restrictions, and harassment incidents underscore the persistence of swarm-based concepts in one of the world's most critical energy chokepoints. This paper analyzes the doctrinal foundations, force structure, operational mechanics, and strategic signaling behind Iran's littoral warfare model. It evaluates counter-swarm measures, escalation risks, and the implications for maritime security, insurance markets, and regional deterrence. By situating swarm deterrence within broader theories of asymmetric conflict and chokepoint strategy, the study assesses whether distributed small-craft tactics remain viable in the sensor-saturated, drone-integrated naval battlespace of the mid-2020s.

Keywords: Strait of Hormuz, Persian Gulf, IRGC Navy, asymmetric warfare, swarm tactics, anti-access area denial, littoral warfare, cost asymmetry, naval deterrence, maritime security, chokepoint strategy, fast attack craft, missile saturation, naval mines, drones, escalation dynamics.

A collaboration with GPT-5.2-Thinking. CC4.0.

Outline

1. Strategic Context: Geography as Force Multiplier
1.1 The Strait of Hormuz as a Global Energy Chokepoint
1.2 Constrained Waters and Radar Clutter
1.3 Historical Precedents of Littoral Asymmetry

2. Organizational Architecture of Iranian Naval Power
2.1 Division of Roles: IRGC Navy and Regular Navy
2.2 Command, Control, and Decentralized Execution
2.3 Integration with Coastal and Air Defense Networks

3. The "Mosquito Fleet" Concept Revisited
3.1 Terminology and Western Analytical Framing
3.2 Fast Attack Craft Capabilities and Limitations
3.3 Speed, Numbers, and Survivability Realities

4. Swarm Tactics and Missile Saturation Doctrine
4.1 Multi-Axis Attack Geometry
4.2 Defensive System Saturation and Cost Imposition
4.3 The Role of Drones and ISR in Swarm Coordination

5. Layered Anti-Access and Area Denial (A2/AD)
5.1 Shore-Based Anti-Ship Missiles
5.2 Naval Mines and Subsurface Assets
5.3 Electronic Warfare and Cyber Components

6. Cost Asymmetry and Economic Leverage
6.1 Comparative Platform Costs and Risk Calculus
6.2 Insurance Markets and Maritime Risk Premiums
6.3 Deterrence Through Disruption Rather Than Destruction

7. Counter-Swarm Strategies and Technological Adaptation
7.1 Layered Defense Systems and Close-In Weapons
7.2 Rotary-Wing, UAV, and Long-Range ISR Countermeasures
7.3 Artificial Intelligence and Target Discrimination

8. Escalation Dynamics and Crisis Signaling
8.1 Naval Drills as Strategic Messaging
8.2 Harassment Incidents and Gray-Zone Operations
8.3 Thresholds of Miscalculation in Constrained Waters

9. Viability in the Mid-2020s Battlespace
9.1 Sensor Saturation Versus Platform Saturation
9.2 The Drone-Integrated Littoral Environment
9.3 Future Proofing the Swarm Model

10. Regional and Global Implications
10.1 Impacts on U.S. and Allied Naval Posture
10.2 Energy Security and Market Stability
10.3 Lessons for Other Regional Powers

11. Theoretical Framing: Asymmetric Naval Deterrence
11.1 Classical Sea Power Versus Distributed Denial
11.2 Geography, Numbers, and the Psychology of Risk
11.3 Deterrence by Complication

12. Conclusion: Swarm Deterrence in an Era of Distributed Warfare
12.1 Summary of Findings
12.2 Operational Complexity as Strategic Tool
12.3 Open Questions for Naval Strategy and Stability

References

Art

1. Strategic Context: Geography as Force Multiplier

Geography is not merely a backdrop to naval operations in the Persian Gulf; it is an active variable that shapes doctrine, platform design, risk tolerance, and escalation dynamics. In open-ocean environments, naval power tends to scale with displacement, endurance, and integrated sensor networks. In confined waters, however, proximity compresses reaction time, multiplies sensor interference, and elevates the importance of maneuverability and dispersion. The Strait of Hormuz and the surrounding Gulf environment exemplify how narrow waterways can convert smaller forces into disproportionate strategic actors. Here, geography amplifies asymmetric tactics and complicates conventional naval superiority.

The Strait's dimensions, traffic density, and proximity to hostile or contested coastlines create a battlespace where small craft, shore-based missiles, and unmanned systems can exert outsized influence. The result is a maritime environment in which speed, numbers, and concealment can rival tonnage and range as determinants of operational leverage.

1.1 The Strait of Hormuz as a Global Energy Chokepoint

The Strait of Hormuz is among the most strategically significant maritime corridors in the world. A substantial percentage of globally traded oil and liquefied natural gas transits this narrow passage daily, linking Gulf producers to Asian, European, and global markets. Its closure or even partial disruption would have immediate implications for energy pricing, insurance markets, and macroeconomic stability.

At its narrowest navigable channel, the Strait provides limited maneuvering room for large vessels. Commercial shipping follows established traffic separation schemes, effectively channeling tankers into predictable transit lanes. This predictability reduces ambiguity for both defenders and potential disruptors. A vessel transiting the Strait cannot easily deviate from prescribed routes without risking collision or grounding, creating operational rigidity that adversaries may exploit.

The chokepoint characteristic also amplifies signaling. Even limited naval drills, temporary closures, or harassment incidents can generate global market reactions disproportionate to the scale of the physical event. The Strait's importance transforms localized tactical actions into strategic communications. In this environment, naval activity is not solely military maneuver but also economic signaling. The mere possibility of disruption can serve deterrent or coercive purposes without the need for sustained kinetic engagement.

Thus, geography functions as both physical constraint and economic multiplier. The narrowness of the Strait compresses naval maneuver space, while its global energy role magnifies the political and financial consequences of any confrontation.

1.2 Constrained Waters and Radar Clutter

The Persian Gulf is shallow, warm, and densely trafficked. Its hydrographic and electromagnetic environment complicates modern naval sensing and targeting in several ways.

First, shallow waters limit submarine maneuver and favor smaller surface platforms capable of operating close to shorelines. Larger vessels, particularly deep-draft ships, are restricted in movement and must account for undersea topography and navigational hazards. Smaller craft can exploit coastal inlets, islands, and nearshore concealment to stage or disperse rapidly.

Second, radar clutter is intrinsic to confined and heavily trafficked waterways. Civilian vessels, fishing boats, coastal infrastructure, and commercial traffic produce dense returns on radar screens. Distinguishing hostile fast attack craft from legitimate maritime activity requires rapid identification and discrimination under compressed timelines. This challenge intensifies in swarm scenarios where numerous small contacts may converge simultaneously.

Third, electromagnetic congestion further complicates detection and engagement. Commercial communications, coastal radar emissions, and electronic interference create a complex spectrum environment. Small craft operating at high speed present reduced radar cross-sections compared to larger vessels, potentially shortening detection windows. When combined with short engagement distances, this environment compresses the decision cycle for defensive systems.

Finally, proximity to land enables integration with shore-based sensors and missile batteries. A force operating within sight of its coastline can rely on overlapping radar coverage, pre-surveyed firing coordinates, and rapid resupply from nearby bases. This adjacency reduces the need for blue-water endurance and shifts the focus toward rapid sortie generation and dispersal.

In sum, constrained waters diminish some advantages of large, open-ocean fleets while enhancing the survivability and relevance of distributed small-craft formations. Geography narrows the engagement envelope and intensifies the importance of reaction time.

1.3 Historical Precedents of Littoral Asymmetry

The strategic logic underpinning swarm tactics and small-craft emphasis is not novel. Throughout naval history, weaker maritime powers have leveraged confined waters and distributed platforms to offset superior fleets.

In the ancient Mediterranean, smaller triremes and coastal forces exploited narrow straits and island chains to counter larger navies. Control of chokepoints frequently determined trade flows and imperial influence. During the age of sail, privateers and fast coastal vessels targeted merchant shipping rather than capital ships, applying pressure through economic disruption rather than decisive fleet engagement.

In the twentieth century, the proliferation of torpedo boats and later missile boats reflected similar asymmetries. Fast, lightly armored craft armed with high-impact weapons sought to challenge larger warships at relatively low cost. The logic was straightforward: a small platform equipped with a powerful strike capability could impose disproportionate risk on more expensive vessels.

The so-called “Tanker War” phase of the Iran–Iraq conflict in the 1980s demonstrated the vulnerability of commercial shipping in confined Gulf waters. Mine deployments, missile strikes, and harassment operations illustrated how regional actors could affect global energy transit without commanding blue-water dominance. Even limited attacks generated insurance spikes and international naval deployments.

More broadly, littoral warfare has consistently rewarded forces that combine local knowledge, rapid maneuver, and dispersed assets. Coastal geography has historically enabled weaker states to practice sea denial rather than sea control. Instead of seeking command of the sea, they aim to render it hazardous or politically costly for adversaries.

The Persian Gulf continues this historical pattern. Swarm tactics, missile integration, and distributed platforms represent a contemporary expression of an enduring strategic principle: in narrow waters, geography compresses the battlespace and redistributes power. The ability to exploit this compression can transform modest platforms into instruments of strategic leverage.

In this sense, geography is not neutral terrain but an operational partner. It multiplies certain capabilities, constrains others, and shapes the cost-benefit calculations of all actors involved. Any analysis of asymmetric maritime doctrine in the Strait of Hormuz must therefore begin with the recognition that the environment itself is an active force in the strategic equation.

2. Organizational Architecture of Iranian Naval Power

Iran’s maritime strategy is not defined solely by platforms, but by institutional design. The country maintains two parallel naval forces with distinct missions, doctrines, and operational cultures. This dual-structure model allows Tehran to pursue both conventional blue-water ambitions and asymmetric littoral denial within a unified national defense framework. The architecture is designed to reduce vulnerability, diversify capability, and embed asymmetry at the structural level rather than merely the tactical level.

Unlike many navies that centralize authority within a single service, Iran deliberately separates responsibilities between its regular navy and the naval branch of the Islamic Revolutionary Guard Corps. This division reduces single-point institutional failure, encourages doctrinal specialization, and reinforces regime security priorities. The result is a maritime force structure

optimized for layered denial in confined waters while maintaining limited expeditionary capacity.

2.1 Division of Roles: IRGC Navy and Regular Navy

Iran's naval forces are split between the regular Islamic Republic of Iran Navy and the Islamic Revolutionary Guard Corps Navy. While both report to national leadership, they operate under distinct chains of command and pursue different operational philosophies.

The regular navy focuses primarily on blue-water missions. Its responsibilities include extended deployments in the Gulf of Oman, Arabian Sea, and occasionally beyond. It operates larger surface vessels, submarines, and logistical platforms suited for longer-range patrol and symbolic flag presence. Its doctrine aligns more closely with conventional naval paradigms centered on endurance, patrol, and maritime domain awareness.

By contrast, the IRGC Navy concentrates on littoral warfare within the Persian Gulf and Strait of Hormuz. Its platform mix emphasizes fast attack craft, small patrol vessels, missile boats, and unmanned systems. Its operational mindset is rooted in asymmetric confrontation rather than sustained open-ocean operations. Where the regular navy seeks presence and patrol, the IRGC Navy seeks disruption and denial.

This separation serves strategic ends. In peacetime, the regular navy conducts formal engagements and international port calls, maintaining state-to-state naval legitimacy. In crisis or conflict, the IRGC Navy is positioned to execute rapid, decentralized operations in confined waters. The duality provides flexibility: one arm projects conventional legitimacy, the other projects unconventional deterrence.

2.2 Command, Control, and Decentralized Execution

A defining feature of Iran's asymmetric naval doctrine is its emphasis on distributed operations. Swarm tactics require coordination without overreliance on centralized command nodes that could be targeted or disrupted. The IRGC Navy appears structured to operate with mission-type orders, allowing subordinate units to adapt rapidly under broad strategic guidance.

Decentralization reduces vulnerability to electronic warfare and command disruption. If communications degrade, small craft units can still operate based on pre-established operational concepts and geographic familiarity. The Gulf's confined geography further enables this model, as units operate within relatively short distances of coastal bases and support infrastructure.

This structure also complicates adversary targeting. Instead of a single fleet concentration, forces are dispersed across multiple coastal facilities, islands, and mobile staging areas. Rapid

sortie generation and dispersal increase uncertainty for opponents attempting to anticipate movement patterns.

At the same time, decentralized execution does not imply disorganization. Layered radar coverage, pre-surveyed firing positions, and established patrol grids enable coordination even among numerous small platforms. In a crisis, command likely shifts toward rapid response cells capable of synchronizing multi-axis operations without extended decision cycles.

The organizational philosophy reflects a broader asymmetric logic: resilience through dispersion. By reducing reliance on high-value command nodes and concentrating instead on distributed operational autonomy, the naval architecture seeks to withstand early strikes while preserving retaliatory capacity.

2.3 Integration with Coastal and Air Defense Networks

Iran's maritime posture cannot be understood in isolation from its broader anti-access and area denial ecosystem. The naval forces are integrated with coastal missile batteries, air defense systems, and unmanned aerial platforms. This integration transforms small surface craft into components of a layered denial network rather than standalone assets.

Shore-based anti-ship missiles extend engagement range beyond the immediate reach of fast attack craft. Coastal launch sites, often mobile or concealed, provide depth to the defensive perimeter. Naval units operating near the coast can draw upon overlapping fields of fire from land-based systems, increasing survivability and strike flexibility.

Air defense systems further reinforce this network. Protecting coastal infrastructure and staging areas reduces the vulnerability of naval assets to preemptive strikes. If an adversary must first suppress layered air defenses before targeting maritime nodes, operational timelines lengthen and risk escalates.

Unmanned aerial systems add another layer. Drones provide reconnaissance, targeting support, and potentially strike capability. By extending situational awareness beyond the horizon of individual boats, unmanned platforms help coordinate distributed units. The integration of surface craft with airborne sensors and coastal missiles creates a multi-domain mesh rather than a linear fleet formation.

This networked architecture reinforces deterrence. An adversary operating in the Strait must account not only for visible surface vessels but also for unseen missile batteries, surveillance drones, and integrated defense systems. The uncertainty of origin complicates retaliation decisions and increases the perceived cost of engagement.

In combination, the dual-navy structure, decentralized command philosophy, and layered coastal integration form a coherent organizational design. It is built not to mirror major naval

powers but to exploit geography, distribute risk, and impose complexity. The architecture itself embodies asymmetric intent, ensuring that maritime confrontation in the Gulf is never limited to ship-to-ship engagement but unfolds within a broader, interconnected defensive system.

3. The "Mosquito Fleet" Concept Revisited

The phrase "Mosquito Fleet" has become a convenient shorthand for Iran's emphasis on numerous small, fast, and relatively inexpensive maritime platforms operating in confined waters. Yet the concept deserves careful re-examination. It is not a formal doctrinal label used by Iran, but rather an analytical construct applied by external observers to describe a broader strategic logic: distributed presence, rapid maneuver, and cumulative pressure rather than decisive fleet engagement.

At its core, the concept reflects a shift away from platform-centric naval warfare toward systems-based denial. Instead of concentrating combat power in large vessels, the emphasis is on dispersing it across many nodes that can operate semi-independently yet converge operationally when required. The value of the approach lies less in any single craft's capability than in the aggregate effect of coordinated movement, targeting, and timing.

3.1 Terminology and Western Analytical Framing

The term "Mosquito Fleet" originates from historical naval discourse describing swarms of small vessels used to harass larger ships. Western analysts have applied it to Iran's maritime posture to capture the asymmetry between platform size and intended strategic effect.

This framing highlights several assumptions. First, that numerous small platforms can impose disproportionate risk on larger naval assets. Second, that geographic constraints amplify the effectiveness of distributed forces. Third, that the cumulative operational burden of tracking and countering many small targets can erode the advantages of technologically superior fleets.

However, the term also simplifies a more complex reality. Iran's small-craft emphasis is embedded within a layered system that includes coastal missiles, mines, drones, and surveillance networks. The focus on boats alone risks overlooking the broader denial architecture in which they operate. The "Mosquito Fleet" is therefore best understood as a visible component of a distributed maritime strategy rather than its entirety.

Western framing tends to emphasize swarm attacks and missile saturation, while Iranian perspectives likely emphasize resilience, rapid sortie generation, and deterrent signaling. The difference in framing reflects differing strategic cultures: one focused on threat assessment, the other on cost imposition and defensive depth.

3.2 Fast Attack Craft Capabilities and Limitations

Fast attack craft form the operational backbone of the distributed model. Their primary strengths derive from maneuverability, shallow draft, and reduced signature relative to larger vessels. Operating close to shore, they can exploit coastal features for concealment and staging.

Many are equipped with anti-ship missiles, rocket systems, or machine guns suitable for harassment and interdiction roles. Their small size allows rapid acceleration and agile maneuvering, enabling approach and dispersal under compressed timelines. When operating in groups, they can present multiple vectors of potential engagement.

Yet these advantages coexist with notable limitations. Light construction reduces survivability under sustained fire. Limited endurance constrains operations to relatively short ranges from coastal bases. Sensor capacity is typically less robust than that of larger platforms, making them reliant on external targeting information from shore-based systems or unmanned aerial support.

Weather and sea state further influence performance. While well-suited to calm or moderate conditions common in the Gulf, small craft are more sensitive to rough seas than larger ships. This introduces environmental variability into operational planning.

Thus, fast attack craft are best seen as force multipliers within a network rather than independent strike platforms. Their effectiveness depends on integration with surveillance, targeting, and support systems that extend beyond the vessels themselves.

3.3 Speed, Numbers, and Survivability Realities

The strategic value of small-craft formations arises from the interplay of speed, numerical presence, and distributed survivability rather than any single attribute.

Speed enables rapid repositioning within confined waters. High maneuverability allows craft to exploit gaps in surveillance or approach along unexpected axes. However, speed alone does not ensure survivability; it must be combined with dispersion and environmental familiarity.

Numbers contribute to operational complexity. Multiple contacts moving simultaneously can complicate identification and engagement processes for defenders. The presence of civilian maritime traffic in the Gulf adds further ambiguity, increasing the burden of discrimination.

Survivability derives less from armor or defensive systems and more from distribution. Instead of relying on individual robustness, the concept relies on redundancy. Loss of individual units does not eliminate the operational capability of the broader network.

At the same time, modern defensive systems and surveillance technologies impose constraints. Advanced sensors, layered defenses, and unmanned reconnaissance platforms reduce the

anonymity that small craft once enjoyed. The survivability of such formations therefore depends increasingly on integration with electronic, aerial, and coastal assets.

In practical terms, the “Mosquito Fleet” concept functions as a method of complicating engagement rather than guaranteeing success. Its strength lies in raising uncertainty and operational cost for an adversary. Its limitations reflect the inherent vulnerability of lightly built platforms operating within range of sophisticated defensive systems.

Revisiting the concept through this lens reveals a balance between opportunity and constraint. Speed and numbers can generate tactical pressure, but survivability depends on networked support and geographic advantage. The fleet’s strategic relevance lies not in defeating superior forces outright but in shaping the conditions under which confrontation occurs.

4. Swarm Tactics and Missile Saturation Doctrine

Swarm tactics represent a shift from platform-centric naval engagements toward distributed pressure applied across time and space. Instead of seeking decisive encounters between major vessels, the objective is to generate simultaneous threats from multiple directions, forcing an adversary to divide attention and resources. In confined maritime environments, where reaction windows are short and maneuver space is limited, this approach transforms numerical dispersion into operational leverage.

Missile saturation is closely linked to this logic. Even advanced defensive systems possess finite engagement capacity. By presenting numerous inbound threats in rapid succession, attackers seek to compress defensive timelines and exhaust intercept resources. The goal is not necessarily to overwhelm through sheer firepower, but to introduce uncertainty and force defensive prioritization under pressure.

4.1 Multi-Axis Attack Geometry

Swarm tactics rely on spatial dispersion rather than linear concentration. Small craft operating from multiple coastal points or island bases can approach from different vectors simultaneously. This multi-axis geometry complicates defensive orientation, as sensors and weapons must track contacts across a broader arc.

In narrow waterways, such as those found in the Persian Gulf, approach routes are constrained yet numerous. Fast craft can exploit shallow coastal zones and traffic lanes to stage from varied positions before converging. The result is not a single wave but a distributed pattern of movement that compresses response time.

Multi-axis geometry also affects defensive decision-making. Systems optimized for forward engagement may be less effective when threats emerge laterally or from the rear. The necessity to maintain 360-degree awareness increases cognitive and technical burden.

Coordination among dispersed units enhances this effect. Even without tight central control, pre-planned timing and geographic familiarity allow multiple elements to arrive within overlapping engagement windows. The geometry of approach thus becomes a tactical tool, transforming physical dispersion into synchronized pressure.

4.2 Defensive System Saturation and Cost Imposition

Modern naval defenses are designed to counter missiles, aircraft, and surface threats through layered engagement. However, these systems operate within finite parameters. Each interceptor, radar track, or engagement cycle represents a resource commitment.

Saturation seeks to exploit these limits. By presenting numerous potential threats within a compressed timeframe, attackers aim to force defenders into rapid allocation decisions. Even unsuccessful attacks can impose cost by triggering intercept launches or operational maneuvers.

The economic dimension is significant. Defensive interceptors and precision munitions are often orders of magnitude more expensive than the platforms or weapons they counter. This asymmetry creates a scenario in which repeated defensive responses impose cumulative financial and logistical strain.

Operationally, saturation introduces uncertainty. Defensive systems must discriminate between genuine threats and potential decoys under time pressure. The presence of civilian maritime traffic in the region further complicates identification.

Thus, the doctrine does not depend solely on kinetic success. The act of forcing defensive expenditure and vigilance can itself serve strategic aims. Sustained readiness requirements increase operational tempo and resource allocation, shaping adversary posture even in the absence of decisive engagements.

4.3 The Role of Drones and ISR in Swarm Coordination

Unmanned aerial systems and surveillance assets extend the reach and coherence of dispersed maritime units. Drones can provide real-time reconnaissance, track target movement, and relay information across distributed formations.

In environments where line-of-sight from small craft is limited, aerial sensors enhance situational awareness. This allows surface units to maintain dispersion while still participating in coordinated action.

Intelligence, surveillance, and reconnaissance capabilities also support targeting accuracy. Shore-based radar, airborne sensors, and unmanned platforms can supply cueing data that compensates for the limited onboard sensors of smaller vessels.

Beyond targeting, drones contribute to timing and deconfliction. Coordinating multiple units requires shared awareness of movement and engagement windows. ISR networks facilitate this synchronization without necessitating constant centralized command.

The integration of unmanned systems therefore transforms swarm tactics from loosely coordinated harassment into a more structured operational concept. Distributed units can act with greater coherence while retaining the flexibility inherent in decentralized execution.

Together, multi-axis geometry, saturation logic, and ISR integration form a cohesive doctrine. The objective is not to match adversaries in platform capability, but to impose complexity, cost, and uncertainty through distributed action in a constrained maritime environment.

5. Layered Anti-Access and Area Denial (A2/AD)

Iran's maritime posture is best understood not as a collection of independent tactics but as an integrated denial system designed to complicate access, compress timelines, and elevate operational risk for adversaries operating near its coastline. In this framework, fast attack craft are only one layer within a broader architecture that includes shore-based missiles, naval mines, subsurface platforms, and non-kinetic capabilities. The objective is not to control the sea in a traditional sense, but to render it hazardous enough that intervention becomes costly and uncertain.

Layering is central to this approach. Each component addresses a different aspect of maritime vulnerability, from long-range targeting to close-in disruption. When combined, these elements create overlapping zones of threat that force adversaries to consider multiple vectors simultaneously. The effect is cumulative rather than singular, shaping decision-making through perceived risk.

5.1 Shore-Based Anti-Ship Missiles

Coastal missile batteries extend the reach of maritime denial beyond the immediate operating radius of small surface craft. Positioned along shorelines, islands, or mobile launch platforms, these systems provide standoff capability against vessels transiting confined waters.

Operating from land offers several advantages. Launchers can be concealed, relocated, or hardened against attack, reducing vulnerability compared to exposed maritime platforms. Pre-

surveyed firing coordinates and fixed geographic reference points enhance targeting reliability. Integration with coastal radar and aerial surveillance further improves cueing.

Shore-based systems also introduce ambiguity. Adversaries must account for potential missile launch points across a broad coastal frontage rather than focusing solely on visible surface vessels. This uncertainty complicates route planning and defensive posture.

In practice, coastal missiles function as a force multiplier for maritime units. Surface craft operating within their protective envelope gain depth and deterrent weight. The presence of land-based strike options extends the engagement space and reinforces the layered nature of the denial architecture.

5.2 Naval Mines and Subsurface Assets

Naval mines represent one of the most enduring tools of maritime asymmetry. Their value lies not only in their destructive potential but in the uncertainty they create. Even the suspicion of mine deployment can slow or reroute shipping, impose clearance requirements, and generate operational caution.

In shallow and confined waters, mines can be deployed in patterns that exploit traffic lanes and navigational constraints. Their passive nature allows them to persist without continuous oversight. Detection and clearance operations are resource-intensive and time-consuming, diverting attention from other tasks.

Subsurface platforms complement this layer. Smaller submarines or submersible vehicles can operate close to shore, providing reconnaissance, mine deployment, or limited strike capability. Their presence increases the perceived density of threats beneath the surface.

Together, mines and subsurface assets extend denial into the undersea domain. They introduce temporal complexity, as their effects endure beyond the moment of deployment. This persistence aligns with the broader objective of shaping behavior rather than achieving immediate tactical outcomes.

5.3 Electronic Warfare and Cyber Components

Non-kinetic tools add a further dimension to the layered system. Electronic warfare can disrupt communications, degrade sensor performance, or introduce ambiguity into targeting processes. In congested electromagnetic environments, even modest interference can affect situational awareness.

Cyber capabilities offer additional avenues for influence. Targeting logistical networks, navigation systems, or supporting infrastructure can complicate operations without direct

confrontation. These actions operate below traditional thresholds of engagement, aligning with the broader emphasis on gray-zone activity.

Integration is key. Electronic and cyber tools enhance the effectiveness of kinetic layers by shaping the informational environment in which decisions are made. Disrupted communications or degraded sensor feeds can delay response, amplify uncertainty, and increase reliance on defensive measures.

In combination, these layers form a multidomain denial architecture. Shore-based missiles extend reach, mines and subsurface assets introduce persistence, and electronic tools shape perception. The result is not a single barrier but a dynamic system designed to raise the cost and complexity of maritime operations near the Iranian coastline.

6. Cost Asymmetry and Economic Leverage

In confined maritime theaters where geography compresses time and space, the balance of power is influenced not only by technology but by economics. Iran's asymmetric maritime posture is built around the principle that relatively inexpensive assets, when deployed in sufficient number and within favorable terrain, can impose disproportionate financial and operational burdens on more advanced naval forces. The objective is not to match adversaries symmetrically but to shape their decision-making through cumulative cost and risk.

Cost asymmetry operates at multiple levels. It affects procurement, readiness, defensive expenditure, and even commercial confidence in maritime transit. By leveraging lower-cost platforms and distributed deployment, Iran seeks to alter the calculus of intervention, turning routine presence into a potentially expensive commitment for outside powers.

6.1 Comparative Platform Costs and Risk Calculus

Large naval platforms represent substantial investments in capital, training, and maintenance. Their deployment reflects long-term strategic planning and significant resource allocation. By contrast, smaller surface craft and supporting systems can be produced and maintained at far lower cost.

This disparity creates an uneven exchange dynamic. The potential damage to a high-value asset from even a modest attack introduces strategic risk beyond the immediate tactical outcome. The loss or impairment of a major vessel carries financial, operational, and symbolic consequences.

From a planning perspective, this alters the risk calculus. Decision-makers must weigh not only the probability of attack but the potential impact of even limited success. Defensive measures,

patrol patterns, and rules of engagement may all be influenced by the need to mitigate asymmetric threats.

Cost asymmetry also shapes sustainment. Maintaining high readiness against distributed threats requires continuous surveillance and defensive posture, both of which incur ongoing expenditure. Over time, these costs accumulate, potentially exceeding the investment required by the smaller force to sustain its denial capabilities.

6.2 Insurance Markets and Maritime Risk Premiums

The economic effects of maritime tension extend beyond naval forces to commercial shipping and global trade. The Strait of Hormuz serves as a vital corridor for energy transit, and its perceived security directly influences insurance rates and freight costs.

Even limited incidents—such as harassment, temporary closures, or naval exercises—can affect market perception. Insurers adjust risk premiums based on threat assessments, which in turn influence shipping costs and routing decisions.

Increased premiums raise the cost of transit for energy producers and consumers alike. Shipping companies may seek alternative routes or delay movement, affecting supply chains. The financial ripple effects can extend into commodity pricing and broader economic indicators.

Thus, asymmetric maritime activity has an indirect leverage mechanism. By introducing uncertainty into a critical trade corridor, a regional actor can exert influence beyond the immediate tactical domain. The economic dimension amplifies the strategic value of disruption.

6.3 Deterrence Through Disruption Rather Than Destruction

Traditional naval deterrence often emphasizes decisive engagement and the ability to dominate open-ocean battlefields. In contrast, Iran’s approach aligns with a concept of deterrence through disruption.

The objective is not necessarily to destroy opposing forces but to create conditions in which sustained presence becomes burdensome. The prospect of increased operational cost, logistical strain, and market volatility can shape adversary behavior.

Disruption operates across multiple domains. Maritime incidents may trigger defensive responses, insurance adjustments, and diplomatic signaling. Each response carries its own cost and complexity.

By focusing on the ability to complicate rather than conquer, the doctrine seeks to deter intervention through uncertainty. The strategic message is that engagement in confined waters will entail ongoing expense and risk, even in the absence of decisive confrontation.

In this way, cost asymmetry becomes a tool of influence. It transforms relatively modest investments into instruments capable of shaping broader strategic and economic outcomes.

7. Counter-Swarm Strategies and Technological Adaptation

As swarm-oriented maritime tactics have matured, so too have the countermeasures designed to mitigate them. Modern naval forces recognize that distributed small-craft threats are less susceptible to traditional ship-to-ship engagement models. Instead of relying solely on stand-off weaponry or platform superiority, counter-swarm strategies emphasize layered defense, persistent surveillance, and rapid decision support.

The challenge is not simply detecting individual fast craft but managing multiple simultaneous contacts in a cluttered environment. This requires integration across sensors, platforms, and engagement systems. Technological adaptation has therefore focused on compressing response timelines, improving discrimination, and enabling scalable defensive responses.

7.1 Layered Defense Systems and Close-In Weapons

Layered defense remains the foundational approach to countering distributed threats. Rather than relying on a single interception mechanism, modern warships employ multiple concentric rings of protection.

Outer layers focus on early detection and engagement at longer ranges, often through missiles or aircraft. Mid-range systems provide additional interception capability against incoming threats that penetrate initial defenses. The innermost layer relies on rapid-response close-in weapons designed to neutralize threats at short distances.

Close-in systems are particularly relevant against fast surface craft. Their high rate of fire and rapid tracking capability allow them to engage targets that approach within compressed timelines. When integrated with radar and electro-optical sensors, these systems provide a final safeguard against saturation attempts.

Layering distributes defensive workload. Instead of relying on a single engagement point, multiple systems share responsibility. This reduces the likelihood that any one layer becomes overwhelmed and increases resilience against coordinated approaches.

7.2 Rotary-Wing, UAV, and Long-Range ISR Countermeasures

Airborne assets extend defensive reach beyond the immediate vicinity of a vessel. Rotary-wing platforms can conduct reconnaissance, track fast-moving contacts, and provide targeting data for surface-based systems.

Unmanned aerial vehicles further enhance persistence. Their endurance allows continuous monitoring of maritime approaches, enabling earlier detection of dispersed formations. By identifying patterns of movement, UAVs contribute to anticipatory defense rather than reactive engagement.

Long-range intelligence, surveillance, and reconnaissance networks complement these capabilities. Satellite imagery, maritime patrol aircraft, and integrated sensor grids provide broader situational awareness. This networked approach reduces reliance on any single platform's sensors.

The combined effect is an expanded detection envelope. Instead of confronting threats only when they approach within visual or radar range, naval forces can monitor activity at greater distances and adjust posture accordingly.

7.3 Artificial Intelligence and Target Discrimination

The proliferation of small contacts in cluttered environments places significant demands on human operators. Distinguishing between benign maritime traffic and potential threats requires rapid assessment under time pressure.

Artificial intelligence offers tools to assist in this process. Machine learning algorithms can analyze sensor data to identify anomalous patterns or behaviors indicative of hostile intent. Automated tracking systems help maintain situational awareness even when contact density is high.

AI-driven decision support can also prioritize engagement options. By evaluating threat trajectories and proximity, systems can suggest optimal responses across layered defenses. This reduces cognitive load and shortens response timelines.

Importantly, AI does not replace human judgment but augments it. Operators retain control over engagement decisions while benefiting from enhanced data processing.

In the context of swarm threats, improved discrimination is critical. Effective countermeasures depend on identifying genuine threats without expending resources unnecessarily. AI-enabled analysis therefore contributes to both operational efficiency and cost management.

Together, layered defenses, airborne surveillance, and intelligent decision support form a cohesive response to distributed maritime threats. Technological adaptation continues to evolve, reflecting the dynamic interplay between asymmetric tactics and conventional countermeasures.

8. Escalation Dynamics and Crisis Signaling

Maritime interactions in the Persian Gulf rarely unfold as isolated tactical events. Instead, they operate within a broader signaling environment where movements, exercises, and encounters communicate intent as much as they achieve operational objectives. In a region defined by narrow waterways, dense traffic, and global economic sensitivity, even limited actions can carry strategic meaning.

Escalation dynamics are therefore shaped not only by capability but by perception. Activities at sea—whether routine patrols or coordinated drills—can be interpreted as reassurance, deterrence, or provocation depending on timing and context. The same maneuver may serve defensive preparation in one reading and coercive signaling in another.

Crisis signaling in this environment is often indirect. Rather than formal declarations, states employ demonstrations of readiness or capability to influence adversary expectations. The presence of distributed maritime forces and layered denial systems allows signaling without immediate escalation to overt conflict.

8.1 Naval Drills as Strategic Messaging

Naval exercises serve dual purposes: operational training and strategic communication. When conducted in or near sensitive waterways, they convey readiness and resolve.

Drills involving coordinated movement, live-fire elements, or rapid deployment illustrate capability without crossing into sustained confrontation. The temporary restriction of maritime zones during exercises can underscore control over local waters while remaining within the framework of routine activity.

Timing amplifies the message. Exercises conducted during periods of diplomatic tension or heightened regional stress may be interpreted as deliberate demonstrations. They can signal both deterrent intent and preparedness for escalation.

From a signaling perspective, drills communicate through visibility. Observed formations, movement patterns, and operational tempo provide cues about doctrine and readiness. Even when framed as routine, their strategic resonance is shaped by context.

8.2 Harassment Incidents and Gray-Zone Operations

Encounters involving close approaches, hailing of commercial vessels, or shadowing of naval units occupy a space below open conflict. These actions are often categorized as gray-zone operations—activities that exert pressure without triggering formal hostilities.

Such incidents introduce friction into maritime routines. Commercial vessels may adjust course, naval units may alter posture, and insurers may reassess risk. The cumulative effect extends beyond the immediate interaction.

Gray-zone actions serve multiple purposes. They test responses, gather intelligence on operating patterns, and reinforce claims of presence or control. By remaining below the threshold of overt attack, they preserve strategic ambiguity.

At the same time, repeated interactions can normalize tension. Regular exposure to low-level confrontation shapes expectations and may recalibrate thresholds of acceptable behavior. This gradual adjustment influences crisis stability over time.

8.3 Thresholds of Miscalculation in Constrained Waters

The same geographic features that enable asymmetric tactics also heighten the risk of unintended escalation. Narrow channels and dense traffic compress reaction time and reduce maneuvering space.

In such conditions, rapid decision-making becomes necessary. Misinterpretation of intent—whether by surface units, aerial assets, or command authorities—can transform routine encounters into crises.

Communication challenges exacerbate this risk. Differences in language, signaling protocols, or electronic interference can impede clarification during tense interactions.

Thresholds of miscalculation are therefore shaped by both physical and informational constraints. A maneuver intended as signaling may be perceived as preparation for attack. A defensive response may appear escalatory.

Managing these thresholds requires balancing deterrence with restraint. The presence of distributed maritime forces and layered denial capabilities introduces both stability and volatility. While they deter large-scale incursions, they also increase the density of interactions where misinterpretation may occur.

In confined waters, escalation is less likely to emerge from deliberate intent than from cumulative ambiguity. Understanding crisis signaling in this context involves recognizing how geography, capability, and perception intersect to shape outcomes.

9. Viability in the Mid-2020s Battlespace

The continued relevance of distributed small-craft tactics in the mid-2020s depends on how effectively they adapt to an increasingly transparent battlespace. Advances in sensing,

networking, and precision engagement have narrowed the margins that once favored concealment and surprise in confined waters. At the same time, geography and traffic density still complicate detection and attribution. The question is no longer whether swarms can exist, but whether they can impose sufficient uncertainty to influence outcomes in an environment shaped by persistent surveillance and rapid response.

Viability thus hinges on the balance between visibility and complexity. If distributed forces can generate more decision pressure than modern sensors can resolve in real time, they retain strategic utility. If, however, sensing and fusion consistently outpace dispersion and maneuver, the advantages of small platforms diminish.

9.1 Sensor Saturation Versus Platform Saturation

Historically, swarm logic emphasized platform saturation—presenting numerous targets to overwhelm defensive capacity. In the contemporary environment, saturation increasingly occurs at the sensor level. Modern forces employ a web of radar, electro-optical systems, and networked data sources to maintain awareness across wide areas.

The challenge for distributed formations is therefore to manage detectability. Large numbers of platforms can create tracking burdens, but advanced analytics can assist defenders in maintaining contact with multiple targets simultaneously. The contest shifts from counting hulls to managing signatures.

Sensor saturation may arise when numerous contacts generate overlapping returns, complicating classification. Civilian traffic and environmental factors contribute to this complexity. In such contexts, defenders must allocate attention across ambiguous tracks.

Thus, the interplay between platform presence and sensor capability defines viability. Swarm tactics remain effective when they generate more ambiguity than sensing systems can resolve within operational timelines.

9.2 The Drone-Integrated Littoral Environment

Unmanned systems have reshaped littoral warfare. Drones extend reconnaissance, targeting, and communication capabilities across both sides of a maritime interaction.

For distributed forces, drones enhance coordination. They provide situational awareness that compensates for limited onboard sensors and enable dispersed units to operate with greater coherence.

For countering forces, drones offer persistent monitoring. Continuous aerial presence reduces gaps in coverage and enables earlier detection of movement patterns.

The result is a more dynamic environment where both offense and defense benefit from expanded visibility. The integration of unmanned systems into littoral operations transforms the engagement space into a networked domain rather than a collection of isolated platforms.

In this setting, viability depends on how effectively distributed formations integrate unmanned assets into their operational framework.

9.3 Future Proofing the Swarm Model

Adapting to the evolving battlespace requires flexibility. The core logic of distributed presence—imposing complexity through numbers and dispersion—remains relevant, but its implementation must evolve.

Future viability may depend on greater integration with electronic, aerial, and informational tools. Rather than relying solely on physical proximity, distributed forces may emphasize networked coordination and signature management.

Innovation in mobility, communication resilience, and integration with broader denial systems can sustain relevance. The swarm model's strength lies in adaptability; its continued effectiveness will reflect how well it incorporates emerging technologies while leveraging geographic advantage.

In the mid-2020s, the contest is less about replacing one model with another and more about adjusting the balance between visibility and uncertainty. The ability to operate within this balance will determine the enduring role of distributed maritime tactics.

10. Regional and Global Implications

The persistence of distributed maritime denial in the Persian Gulf carries implications that extend beyond local tactics. Because the Strait of Hormuz is embedded in global trade and security architectures, any credible capacity to complicate transit shapes alliance planning, commercial behavior, and the strategic imagination of other coastal states. The result is a feedback loop in which regional posture, energy markets, and doctrinal emulation evolve together.

10.1 Impacts on U.S. and Allied Naval Posture

For the United States and partner navies, a credible swarm-and-layered-denial environment incentivizes dispersion, persistence, and integration. Operational patterns increasingly emphasize continuous maritime domain awareness, rotational presence rather than episodic surges, and tighter linkage between surface forces, airborne sensors, and shore-based partners.

Posture adjustments include enhanced escort practices in high-risk periods, expanded use of unmanned systems for early cueing, and greater reliance on coalition information-sharing to maintain a common operating picture. Exercises are more likely to incorporate convoy defense, mine countermeasures, and rapid deconfliction procedures in cluttered waters.

Doctrinally, planning shifts toward resilience: redundancy in communications, distributed logistics, and rules of engagement calibrated for gray-zone interactions. The emphasis is on sustaining freedom of navigation while minimizing escalation risk—an equilibrium that requires readiness without overcommitment.

10.2 Energy Security and Market Stability

Because energy flows through the Strait are globally consequential, perceptions of risk can be as influential as physical disruption. Even limited incidents—temporary route adjustments, heightened naval activity, or publicized drills—can reverberate through insurance underwriting, freight pricing, and inventory strategies.

Higher perceived risk tends to elevate maritime premiums and encourage hedging behavior among shippers and refiners. Companies may adjust scheduling, diversify routes where feasible, or increase stockpiles to buffer volatility. These responses carry costs that diffuse across supply chains, potentially influencing benchmark prices and refining margins.

Financial markets react to signals as well as events. Announcements of exercises, close approaches at sea, or changes in escort posture can move expectations about continuity of supply. In this sense, the security environment of a chokepoint is inseparable from its economic environment.

10.3 Lessons for Other Regional Powers

Other coastal states observe how geography, distributed assets, and layered systems can combine to offset conventional disadvantages. The Gulf experience illustrates that sea denial—rather than sea control—may be a pragmatic objective in constrained littorals.

Potential lessons include investing in mobile coastal defenses, integrating unmanned surveillance with surface units, and building resilience through dispersion rather than concentration. The importance of aligning doctrine with geography becomes clear: narrow seas reward rapid sortie generation and networked awareness.

At the same time, emulation is not without risk. Proliferation of denial-centric approaches in busy waterways can increase interaction density and the potential for miscalculation. Regional powers must therefore balance the appeal of asymmetry with mechanisms for communication and crisis management.

Collectively, these implications underscore how localized maritime practices can shape broader security dynamics. Posture, markets, and doctrine co-evolve, reflecting the strategic weight of a narrow strait in an interconnected world.

11. Theoretical Framing: Asymmetric Naval Deterrence

Asymmetric naval deterrence departs from the classical pursuit of command of the sea and instead seeks to influence adversary behavior by elevating uncertainty, cost, and operational friction in constrained environments. Its logic is grounded in shaping expectations rather than delivering decisive fleet engagements. In narrow littorals, where proximity compresses timelines and traffic density complicates attribution, deterrence can emerge from the credible ability to disrupt, delay, and impose cumulative burdens. This framing prioritizes resilience, dispersion, and layered effects over concentration and endurance.

11.1 Classical Sea Power Versus Distributed Denial

Traditional sea power theory emphasizes decisive battle, control of sea lines of communication, and sustained presence enabled by large, multi-mission platforms. Distributed denial inverts these priorities. Rather than seeking control, it aims to render access contested and operations persistently costly.

Distributed denial leverages many modest nodes—small surface units, shore-based systems, unmanned sensors—linked by local knowledge and rapid sortie generation. The objective is not to defeat superior fleets outright but to complicate their freedom of action within a defined geography. In this paradigm, success is measured by the degree to which adversaries must allocate additional resources, adopt cautious postures, or accept economic and political risk to maintain routine operations.

The contrast is thus not simply technological but conceptual: concentration versus dispersion, control versus contestation, endurance versus immediacy.

11.2 Geography, Numbers, and the Psychology of Risk

In confined waters, geography amplifies the effect of numbers. Narrow channels and predictable traffic patterns compress maneuver options and shorten decision cycles. When many potential threats can emerge across limited approach vectors, defenders face heightened cognitive and operational demands.

This dynamic feeds into the psychology of risk. Decision-makers must weigh the consequences of low-probability, high-impact outcomes—such as damage to a high-value asset—against the routine costs of sustained vigilance. The presence of numerous modest threats can shift

behavior even absent direct confrontation, encouraging precautionary measures that carry financial and operational implications.

Perception becomes pivotal. If the environment is believed to be persistently hazardous, actors may adjust routing, readiness, and engagement thresholds. Geography and numbers together shape these perceptions, transforming physical constraints into strategic influence.

11.3 Deterrence by Complication

Deterrence by complication focuses on raising the complexity of intervention rather than threatening decisive defeat. By layering potential challenges—ambiguous contacts, constrained maneuver space, and economic sensitivity—distributed denial creates a landscape in which routine operations require elevated effort.

The mechanism is cumulative. Each additional layer—surveillance, mobility, persistence—adds friction to planning and execution. Over time, this friction can alter cost-benefit calculations, encouraging restraint or recalibration of objectives.

Importantly, complication operates below the threshold of open conflict. Its effects are felt through posture adjustments, increased insurance premiums, and expanded defensive measures. The strategic message is that access will not be denied absolutely, but neither will it be uncontested or inexpensive.

In this theoretical frame, deterrence arises from the credible capacity to sustain uncertainty. The goal is not to eliminate adversary options, but to ensure that each option carries enough complexity to shape behavior in advance of confrontation.

12. Conclusion: Swarm Deterrence in an Era of Distributed Warfare

The evolution of littoral conflict in the Persian Gulf illustrates how distributed approaches can shape outcomes without replicating traditional models of sea control. Swarm-oriented tactics, layered denial, and networked sensing do not seek decisive dominance. Instead, they reframe competition around access, persistence, and cost. In a chokepoint where geography compresses time and space, the capacity to generate uncertainty becomes a strategic asset. The analysis throughout this paper has examined how institutional design, multi-domain integration, and economic signaling combine to produce a deterrent posture rooted in complication rather than conquest.

12.1 Summary of Findings

First, geography remains foundational. Narrow waterways, predictable traffic patterns, and proximity to coastline amplify the effectiveness of distributed forces. Second, organizational architecture—particularly the division of roles and decentralized execution—enables rapid adaptation and resilience. Third, the so-called mosquito fleet is best understood as one visible layer within a broader system that includes coastal missiles, mines, subsurface elements, and unmanned surveillance.

Fourth, swarm tactics and missile saturation aim to compress defensive timelines and impose resource burdens. Fifth, layered denial extends influence across surface, subsurface, and informational domains. Sixth, cost asymmetry translates tactical actions into strategic leverage, affecting both military planning and commercial behavior.

Seventh, countermeasures are evolving through layered defenses, airborne surveillance, and decision-support tools. Eighth, crisis signaling in confined waters blends routine activity with strategic messaging, creating thresholds where misinterpretation can escalate tension. Ninth, viability in the mid-2020s hinges on the interplay between visibility and ambiguity in a sensor-rich environment. Tenth, the regional and global implications extend into alliance posture and energy markets. Eleventh, asymmetric naval deterrence reframes success as sustained complication rather than decisive victory.

12.2 Operational Complexity as Strategic Tool

A recurring theme is the use of complexity itself as an instrument of influence. By integrating dispersed platforms, layered capabilities, and non-kinetic tools, distributed maritime strategies create environments in which intervention becomes administratively and economically demanding.

Complexity manifests in multiple forms: the need for continuous surveillance, the requirement to maintain layered defenses, and the obligation to navigate ambiguous encounters in crowded waters. Each dimension adds friction to planning and execution.

Importantly, complexity does not equate to chaos. It is structured through doctrine and geography. The intent is not to overwhelm through force but to shape decision-making through uncertainty and cumulative burden.

In this sense, operational complexity functions as a strategic tool. It alters expectations about the ease and sustainability of external presence, encouraging caution without necessitating confrontation.

12.3 Open Questions for Naval Strategy and Stability

The continued relevance of distributed denial raises several questions for future naval strategy. As sensing and automation improve, will dispersion retain its ability to generate uncertainty? How will unmanned systems influence the balance between visibility and survivability?

Stability also remains a concern. The density of interactions in confined waters increases the potential for miscalculation. Mechanisms for communication and de-escalation will be essential to prevent routine signaling from triggering unintended escalation.

Finally, the broader diffusion of denial-centric approaches among coastal states could reshape maritime norms. The challenge for global naval strategy will be to reconcile freedom of navigation with the realities of increasingly contested littorals.

Swarm deterrence thus occupies a dynamic space between tradition and innovation. Its significance lies not in replacing classical sea power but in redefining how influence is exercised where geography and economics converge.

References

Anthony H. Cordesman and Bryan Gold. *Iran's Military Forces and Warfighting Capabilities*. Center for Strategic and International Studies.

Bryan Clark, Timothy A. Walton, and Jesse Sloman. *Taking Back the Seas: Transforming the U.S. Surface Fleet for Decision-Centric Warfare*. Center for Strategic and Budgetary Assessments.

Caitlin Talmadge. *Closing Time: Assessing the Iranian Threat to the Strait of Hormuz*. International Security.

Christopher Harmer. *Iran's Islamic Revolutionary Guard Corps Navy: How It Fights*. Institute for the Study of War.

Eugene Gholz and Daryl G. Press. *The Gulf War's Legacy for U.S. Maritime Strategy*. International Security.

James Holmes and Toshi Yoshihara. *Red Star over the Pacific: China's Rise and the Challenge to U.S. Maritime Strategy*. Naval Institute Press.

Michael Connell and Ryan Evans. *Iran's "Swarm" Tactics in the Persian Gulf*. Center for Naval Analyses.

Office of Naval Intelligence. *The Iranian Navy: A Tale of Two Navies*. U.S. Department of the Navy.

Phillip Smyth. *The IRGC Navy's Role in Iranian Maritime Strategy*. Washington Institute for Near East Policy.

Reza Azizi and Naysan Rafati. *Iran's Military Strategy and Force Structure*. International Institute for Strategic Studies.

Ronald O'Rourke. *Iran's Naval Forces and Capabilities*. Congressional Research Service.

Sam J. Tangredi. *Anti-Access Warfare: Countering A2/AD Strategies*. Naval Institute Press.

U.S. Department of Defense. *Annual Report on Military Power of Iran*. Defense Intelligence Agency.

International Energy Agency. *World Energy Outlook*.

International Maritime Organization. *Safety and Security of Navigation in the Strait of Hormuz*.

Lloyd's Market Association. *Marine Insurance and War Risk Assessments in High-Risk Waters*.

Martin C. Libicki. *The Future of Electronic Warfare*. RAND Corporation.

Peter Dombrowski and Andrew S. Erickson. *China's Maritime Gray Zone Operations*. Naval War College Review.

Geoffrey Till. *Seapower: A Guide for the Twenty-First Century*. Routledge.

Julian Corbett. *Some Principles of Maritime Strategy*. Longmans, Green and Co.

Alfred Thayer Mahan. *The Influence of Sea Power Upon History*. Little, Brown and Company.

Barry Posen. *Command of the Commons: The Military Foundation of U.S. Hegemony*. International Security.

Andrew F. Krepinevich Jr. *Maritime Competition in a Maturing Precision-Strike Regime*. Center for Strategic and Budgetary Assessments.

International Institute for Strategic Studies. *The Military Balance*.

Jane's Defence Weekly. *Iranian Naval Capabilities Reports*.

U.S. Naval War College. *Maritime Strategy and Littoral Warfare Studies*.

The author has published over 5,000 AI-assisted papers at: https://www.researchgate.net/profile/Douglas-Youvan/research . Google Scholar has indexed these preprints, and if you want a particular reference, the AI mode of a Google search (Gemini) has efficiently catalogued these preprints.